THE MODEL ENGINEER

Vol. 98 No. 2450

THURS MAY 6 1948 9d.

The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, *GREAT QUEEN ST., LONDON, W.C.*2

6TH MAY 1948 VOL. 98 NO. 2450

SMOKE RINGS

Our Cover Picture

● FOR THE centenary of the Swiss railways, in 1947, one of the most striking exhibits was a specially-constructed replica of a locomotive and train which, a hundred years before, had run between Zurich and Baden. It is said that this train was referred to locally as the "Little Spanish Rolls Express." It gained its name in a curious way—in the old days a certain kind of bread roll named "Spaniards" was made at Baden, and most of the passengers from Zurich made the journey merely to buy them "hot from the oven." The replica travelled over many miles of the Swiss railways during the centenary celebrations, and attracted a great deal of attention. Our photograph depicts the front end of the quaint engine, and shows the driver and fireman in period costumes preparing for a run. The funnel is worth some study!—J.N.M.

Photographic Competition

● ONE OF the facts brought to light by our Readers' Referendum is that whilst the prototype and general engineering photographs which we sometimes use as cover pictures are appreciated by the majority, readers on the whole prefer photographs of models. There is, however, a scarcity of good photographs of models, especially of the size and quality suitable for cover pictures. Accordingly, we have decided to run a competition offering prizes of £10, £5, £3 and £2 for the four best photographs of models submitted. We will also pay at our standard rate for any which, whilst not prize winners, we find suitable for publication at a later date. There are no complicated rules to observe. The basis upon which photographs are to be judged will be according to their suitability as cover pictures. The size of the print is not important so long as definition is sharp and contrast good. Neither is it necessary for the picture to be of the upright or portrait shape—often a portion of a horizontal or landscape-shaped picture can be used. A short description, amounting to roughly 100 words, should be written on the back of the photograph together with the sender's name and address. We cannot undertake to acknowledge or return any photographs submitted, and we reserve the right to publish them upon payment of our standard rates. Closing date is Monday, June 21st. Results will be announced as soon as possible after the closing date. Entries marked "Photographic Competition," should be addressed to The Production Manager, THE MODEL ENGINEER, 23, Great Queen Street, W.C.2, whose decision is final.—P.D.

The Model Car Association

● I HAVE been asked by Mr. G. E. Jackson, who is the Honorary Secretary of the newly-formed Model Car Association, to inform the clubs that copies of the provisional rules which embody the terms of affiliation have been sent to all clubs and societies known to have a model car section. There will no doubt be a number of clubs interested in this branch of model engineering which have not been included in Mr. Jackson's list. If the secretary of any such club will write to :—Mr. G. E. Jackson, 1, Lime Grove, Chaddesden, Nr. Derby, he will be pleased to send them a copy of the provisional rules, so that they may, if they so desire, become affiliated to the Association and so enjoy the benefits and advantages which only membership of such an organisation can bring.—P.D.

Fifty Years of the S.M.E.E.

● THE " PARENT " of all our model engineering societies, the Society of Model and Experimental Engineers, celebrates its Golden Jubilee this year ; for it was founded, largely at the instigation of the late Mr. Percival Marshall, in 1898. Today, it is a powerful influence in model engineering circles, and no fewer than forty clubs and societies with similar interests are affiliated to it. To mark the fiftieth anniversary, the S.M.E.E. is holding an exhibition from May 13th to 22nd next, in the Exhibition Pavilion of the Imperial Institute, South Kensington, London, S.W.7. This exhibition will be open from 11 a.m. to 9 p.m. each day, and the charges for admission will be : Adults, 2s. 6d. ; children, 1s. 3d. Conducted parties of children will be admitted at 1s. 0d. per head. Among the exhibits will be models of steam, petrol and other engines, working model locomotives, model railway layouts, model sailing ships, power boats and aeroplanes. An unusual feature will be the display and operation of test-stands, designed and built by members of the society, which will be shown taking actual horse-power tests from models ; there will also be an 8 ft. model of a merchant-ship, designed for radio control and shown with its engines running. Present indications are that the exhibition will be thoroughly worthy of the occasion and should not be missed by our readers.—J.N.M.

The Locomotive Exchanges

● MONDAY, APRIL 19th, was something of a red-letter day for all locomotive zealots, for it marked the beginning of that " test of strength " between various types of British locomotives on other than their normal routes. On that day, I was at Paddington Station to see the 1.30 p.m. West of England express depart. The train was the usual one of fourteen Great Western main-line corridor coaches, but the " King " class engine was not there ; in its place was what used to be the Southern Railway's " Merchant Navy " 4-6-2 type engine *French Line C.G.T.*, now re-numbered 35019. This engine was fairly clean and in the standard S.R. livery of malachite green with golden-yellow lining. Attached to her was a London, Midland and Scottish Railway tender, painted black and with " British Railways " in plain block, straw-coloured letters, placed conspicuously on its side. This multi-coloured procession departed exactly on time ; but what a contrast to the sort of thing I am used to ! Instead of the sonorous, evenly-spaced barks of a " King " or " Castle," came a fluffy, fussy, pulsating hissing sound, several spasms of unrestrained slipping, and a noticeably slow start. Even after the train had got well moving, the engine seemed unable to avoid a recurrance of those slipping potentialities. It reminded me of the days of the French compound Atlantics, if not of the earlier days when single-wheelers would waste steam and power in slipping while trying to start loads that were really too much for them. However, a different story came from Kings Cross, a few days later, when a London, Midland and Scottish rebuilt " Royal Scot," No. 46162, *Queen's Westminster Rifleman*, in well-cleaned black and with L.M.S. very conspicuous on her tender (!), got away with the 1.10 p.m. Leeds express in a manner that seems to have surprised many devotees of the L.N.E.R. I am hoping to have opportunities of seeing something of these tests in places well " down the line," at points where the trains concerned are normally running at good speed ; and I am also hoping to be able to take some photographs of them, because there has never been anything like these tests before, and railway photographers are hoping for good weather between now and the end of August, so as to be able to obtain a full record of an outstanding period in railway history.—J.N.M.

Traction Engine Measurements

● WE HAVE received a letter from Mr. H. M. Taylor of " Glen Vue " Newton Road, Sudbury, Suffolk, who is an agricultural engineer. Having read our " Smoke Ring " seeking information regarding our contributor, " Frost Spike," he writes :

" I too am interested in traction and agricultural engines and would be most happy to supply you and THE MODEL ENGINEER readers with information on this subject. I can give accurate details and measurements of traction engines, as I am in daily contact with them, this being an agricultural district.

" I also note that some writers in THE MODEL ENGINEER give the impression that traction engines are almost extinct. I assure you, sir, this is not so. There are many around here at work every day, the old portable engines, being much in evidence. Burrell single-crank compounds are also frequently seen, as are steam ploughs, etc., too."

We feel sure that readers engaged in the construction of model traction engines will be grateful to Mr. Taylor for his generous offer to supply accurate details and measurements.—P.D.

British Puppet and Model Theatre Guild

● READERS WHO are interested in model theatres may be glad to learn that a series of blueprints dealing with the construction and lighting of model stages and theatres is available from this Guild. Price list for these blueprints and for other relevant literature and materials may be obtained by applying to the Honorary Sales Secretary, Mr. J. C. Dobby, at 64, Pollard Road, Whetstone, London, N.20.—P.D.

*Making Scale Ships' Fittings

Suitable for motor-yachts, cabin-cruisers, A.S.R.Ls., M.T.Bs. and other "light craft"

by W. J. Hughes

THE prototype windlass is built by Messrs. Simpson Lawrence of Glasgow, and is another fitting favoured much on pleasure craft as well as on war-time light craft. It works by ratchet, having a socket into which a handle can be fitted. When the handle is worked backwards and forwards, the warping drum and gipsy revolve at either stroke. On the starboard side, enclosed in the gipsy barrel, is a cone clutch by means of which the anchor may be lowered away, and the "run" of the cable controlled. The handle is the prototype is cast, and has a mooring-bitt or bollard on top.

In the model windlass, which occupies a space less than ½ in. × ½ in., no attempt has been made at a working model, which would have required some very delicate "watch-making." The "exploded" view (Fig. 16) of the model windlass will give an idea as to its construction. The base-plate had two fine saw cuts made lengthwise to take the lower edges of the body, and was reduced in thickness at the edges by filing, after

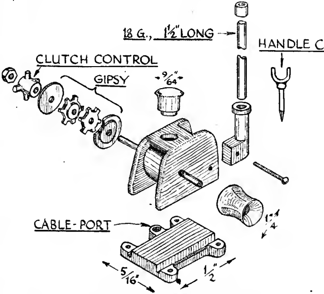


Fig. 16. Exploded view, showing the component parts of the windlass

Fig. 18

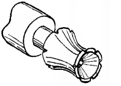


Fig. 17a

Fig. 17b

unshipped when not in use, and lies in chocks on deck. To the tyro I may explain a few terms, perhaps. The warping-drum is the drum at the port side, which has "whelps" or ribs cast on to give a good grip on ropes and/or chains. The "gipsy" or cable lifter has two flanges resembling a very deep vee-pulley, but the flanges have radial teeth or lugs on their inside faces. The links of the chain (cable) fit between these so that a positive pull on it is assured. When the anchor is being "weighed" (hauled inboard), the cable passes up through the stemhead roller to the gipsy, over the latter, and down through the cable-port into the chain locker below deck. The body of which the feet and cable-port were drilled and filed to shape. The body was cut from a piece of flat sheet, filed to shape, and bent up. Having turned the mooring bitt, the body, base and bitt were assembled and silver-soldered together.

Much thought was expended on how to make a realistic looking gipsy and warping-drum in such a small size, and when I hit on the latter especially, I almost shouted "Eureka"—but was restrained by the thought of the domestic authority's displeasure, since the time was about 1 a.m. and the said d.a. was "hard on."

However, the method was as follows. A stub of ¼-in. diameter brass rod was chucked, the end faced and centred, and a groove made with a parting tool ⅛ in. from the end. The shape of the

*Continued from page 453, "M.E.," April 29, 1948.

barrel was turned—note that the diameter is less at the outer than at the inner end—and six tiny vee-notches were filed at its either end, using the chuck jaws as an index (see Fig. 17 [a]). Having centre-popped the rod against No. 1 jaw, so as to be able to replace it accurately in the chuck, pieces of very thin copper wire were placed in the notches, the ends being twisted together (Fig. 17 [b]). Each wire was carefully pressed down to fit the curve of the drum, and they were then silver-soldered to it, using a minimum of solder, which left the tiniest fillet at each side of the wires.

Replacing the rod in the chuck, the surplus wire was now turned away to leave the six whelps alone, standing proud, as in the "exploded" view. A $\frac{1}{16}$-in. drill was run right through, the countersunk end was belled out (using a small triangular scraper), and the completed drum was parted off.

This method could be used in any scale or size of winch or windlass, of course.

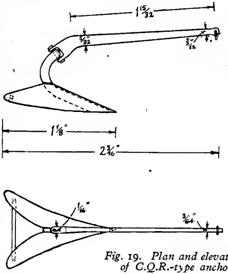


Fig. 19. Plan and elevation of C.Q.R.-type anchor

Construction of the gipsy is also shown in the exploded view. Each lugged part was turned as a disc on the end of a piece of brass rod, and the segments were filed out (Fig. 18). The part having been drilled $\frac{1}{16}$ in., the parting-tool was run right through, leaving a small spigot on the side nearest the chuck. The two flanges were also parted off from $\frac{1}{4}$-in. diameter brass rod, with a small spigot on each; the clutch control was turned as a disc, and the four knobs filed out before parting-off. The "lock-nut" was drilled $\frac{1}{16}$ in., filed to shape, and parted off from $\frac{1}{8}$-in. diameter rod.

A stub of $\frac{5}{16}$ in. diameter rod was parted off (after drilling $\frac{1}{16}$ in.) to fit inside the body to represent the gear-cover, and then the parts of the gipsy, gear-cover, and warping-drum were assembled on a length of $\frac{1}{16}$ in. diameter brass wire slipped through the holes in the body, all bits and pieces having been painted with solder-paint.

The handle socket could have been turned in the four-jaw, but it was considered as less trouble to drill and file it up by hand. It too was "painted," put in place, and its pin pushed through. The whole assembly was then sweated up at one heat.

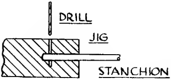


Fig. 20. Drilling-jig for hole in stanchion

A piece of 18-gauge wire forms the handle, with a collar drilled and parted off from 3/32-in. diameter wire sweated on to it at the top. It lies in two chocks formed as shown, and pushed into the deck; it can be seen on Photos 1 and 2 just abaft the windlass.

The Anchor (Photos Nos. 1 and 2)

Prototype of the anchor is the C.Q.R. type, built by the Security Patent Anchor Co., and, like the windlass, fitted to hundreds of "light craft" during the war, as well as to many craft in private ownership.

The plan and elevation given in Fig. 19 show the appropriate dimensions for a $\frac{1}{2}$ in. scale model of the size used in the A.S.R.L.

The "ploughshare" part was filed and bent up to shape from 24-gauge brass, and sweated to the curved bar, cut and filed out of 16-gauge brass—tension file work again! The bar which braces the ploughshare is a piece of 20-gauge wire sweated in place. Another piece of 16-gauge brass was filed to shape for the shank; note that in plan it tapers fairly rapidly at first, then slowly to the shackle end—though it would hardly be noticed if the taper were regular or even non-existent on the model. It is pivoted to the curved bar by means of a household pin through No. 70 holes—I made two shanks because the drill ran off in drilling the first.

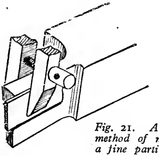


Fig. 21. A quick method of making a fine parting-tool

A shackle bent from a cut-down pin passes through a short length of tinned gold jewellers' chain (sacrilege?), and pivots in a No. 70 hole at the head of the shank. The other end of the chain is sweated into the cable-port of the windlass.

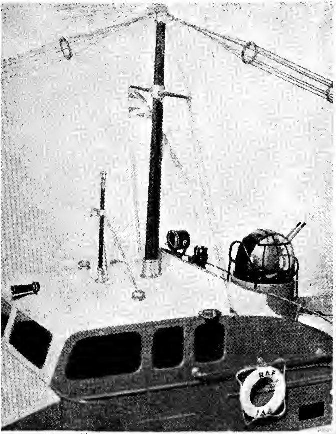


Photo No. 4

speed was far below that really desirable for a drill of this size, it saved much of the mortality which would have resulted from drilling 19 stanchions by hand through silver-steel, even with the jig.

Base flanges were parted off from $\frac{3}{16}$ in. diameter brass, and tinned and sweated to the tinned stanchions, half-an-inch of which protruded through the flanges to be pressed into holes drilled through the deck into the stringer below.

" Guard-rails " are of nylon fishing-line, painted aluminium to represent galvanised wire rope.

Mushroom Ventilators.
(Photos Nos. 4 and 5)

The dwarf ventilators on the wheelhouse roof were plain turning jobs, except that the groove was too narrow for my smallest parting tool. A small

All the parts of the anchor are " galvanised," and it is fastened in chocks on deck—one is a wire loop driven into the deck, fitting over the nose of the plough, and there is a small tee-shaped cleat each side of the shank, to which the latter is lashed.

Guardrail Stanchions

On the prototype the stanchions are of $1\frac{1}{4}$ in. diameter galvanised steel tube welded to base flanges. I thought of using 18-gauge brass wire on the model, but finally decided on $\frac{1}{16}$ in. diameter tinned silver-steel—slightly over scale, but very much stronger than the brass.

A No. 70 hole was drilled near the head of each, using a simple jig (Fig. 20), and fortunately I had access to a drilling-machine for this job. Even though its maximum

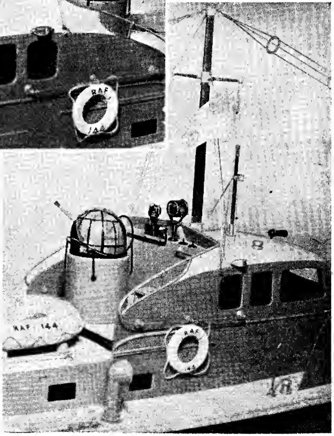


Photo No. 5

piece of broken hacksaw blade was therefore clamped to a larger parting tool, protruding slightly, using a small toolmaker's clamp (Fig. 21), and this turned the groove in the soft brass satisfactorily. For fixing, a spigot $\frac{1}{8}$ in. diameter was left on the base, to be pressed and cemented into a hole in the roof.

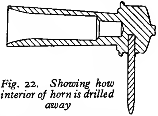


Fig. 22. Showing how interior of horn is drilled away

One of the taller mushroom vents is seen in Photo 5 just aft of the wash-strake. These, too, were simple turning jobs, but for fixing, a small brass wood-screw was beheaded and its shank sweated into a hole drilled centrally up the vent from the bottom. These were screwed through the decks into reinforcing blocks underneath.

Another simple job turned from brass rod, is the electric horn, $\frac{3}{8}$ in. long. After turning the outside to shape, most of the inside was drilled away as shown in Fig. 22. The triangular scraper was used again to flare out the inside of the horn, leaving almost a feather edge.

The fixing dowel of 18-gauge brass wire is sweated into a hole drilled in the body of the horn, and its other end is pressed into a hole drilled undersize in the wheelhouse roof. The latter being balsa, to which it is difficult to secure fittings, holes were previously cut in the necessary places, and filled with plastic wood. When set hard, this *will* give a grip on pins, nails, screws and dowels, unlike the soft, yielding balsa.

Lantern Stanchion (Photos Nos. 4 and 5)

The steaming-light, anchor-light, and signalling lamp are mounted on a stanchion which fits in a socket on the wheelhouse roof. The construction is as shown in Fig. 23.

The socket with its flange was turned from brass rod, with a 3/32-in. hole drilled right through, into the bottom of which a headless woodscrew was subsequently sweated. A tiny eyelet bent up from a pin was sweated into a No. 70 hole in the base flange—this was to take the fore-stay of the main-mast.

A short length of 3/32-in. diameter brass wire forms the stanchion itself, to which the steaming-light mounting is sweated. The latter was filed up from $\frac{3}{16}$ in. square section brass rod, and the "lens" was turned from "catalin crystal," a clear plastic resembling glass. Note the tiny vee-grooves to give the effect of a dioptric lens. After polishing it in the lathe, with metal polish a flat was filed on the back (Fig. 23), and it was parted off.

The anchor and signalling lights are mounted one atop the other at the peak of the stanchion, in the manner shown in the same drawing. It would probably have been easier to sweat a stub of wire into a hole drilled in the stanchion than to turn the tiny spigot. However, the spigot projects into a hole drilled into the catalin "lights." The cap, foot, and intervening flange of these were turned integral with the "lenses"; the latter were polished, of course, but the former were painted with aluminium paint to resemble the other "galvanised" fittings.

A hole was drilled right through the mounting of the steaming-light and through the stanchion, and two 20-gauge tinned brass wire stays were forced into holes in the roof, the top ends of the stays being bent and sweated into the cross-hole just mentioned.

The "lenses" were cemented in place with "Durofix," and the stanchion was painted with a varnish (made by dissolving walnut aniline powder in French polish) to resemble wood. This was afterwards given a coat of clear cellulose to keep it waterproof.

Mainmast Socket (Photo No. 4)

In making the step or socket for the streamlined mainmast, it was decided that the easiest way to form the beading round the top would

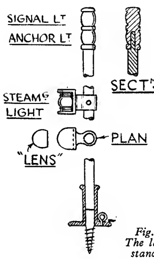


Fig. 23. The lantern stanchion

be to turn a beaded tube, and squeeze that to shape. A piece of brass rod was chucked, centred, and drilled 9/32 in. (the mean of the diameters of the mast) and was turned down to leave the walls a bare 1/32 in. thick, except for the beading, of course. After annealing, the tube was squeezed slightly oval in the vice, and then lightly hammered to the correct shape. The bottom edge was filed a little to give the very slight rake required by the mainmast, and the tube was silver-soldered to a flange of 24-gauge sheet.

When cleaned up and tinned, a countersunk hole was drilled through the base inside the socket, for the fixing screw, with a further tiny hole behind it, through which a pin passes into the roof, to stop any tendency for the socket to turn.

(To be continued)

IN THE WORKSHOP

by "Duplex"

10—Drilling in the Lathe

WHEN a drilling machine is not available in the workshop, or if drills have to be used larger than the drilling machine can accommodate, the lathe may be employed as a substitute. The drill is then mounted in the headstock chuck, and the work is supported by either the tailstock or the lathe saddle.

Although the tailstock is employed to apply the pressure for drilling, by means of its screw-feed mechanism, the end of the barrel should not be used to support the work, for not only is the area of contact insufficient for most purposes, but there is a risk of damaging the tailstock internal taper. Instead, a drilling pad, of the form shown in Fig. 1, should be used when drilling flat work, whilst for drilling holes across the diameter of round shafts, a fitment is used, furnished with a V-groove for positioning the work, as depicted in Fig. 2.

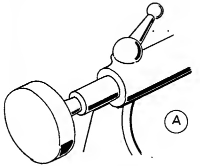


Fig. 1

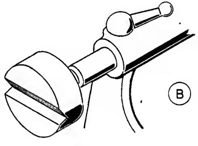


Fig. 2

It is usual, when drilling with the flat form of pad, to interpose a flat piece of wood between the work and the pad in order to protect the drilling face, but in the second type the recess at the bottom of the V allows the drill to break through without causing damage, if care is taken at the close of the drilling operation.

In this connection, the tailstock adapter supplied by some lathe manufacturers will, at times, be found most useful.

This fitting, which was illustrated in a previous article, has a tapered shank for mounting it in either the headstock or tailstock taper, whilst at its other end it is provided with a threaded portion that is a facsimile of the mandrel nose. When this device is fitted to the tailstock, any of the chucks, or other fittings, used on the lathe mandrel can be mounted on the adapter for holding the work.

When a large work table is required, the lathe faceplate can be employed for this purpose and the work clamped in place.

The lathe centre-height, or the height over the saddle, may, however, be insufficient to accommodate the large faceplate designed to run in the lathe gap. To make full use of the height available over the lathe bed, it may be found necessary to move the saddle to the extreme right of the bed, and to detach the tailstock and remount it to the left of the saddle.

When drilling against the tailstock, it will be found advisable to give adequate support to heavy work, either by clamping it to a faceplate, or by means of a packing block resting on the lathe bed or saddle. Otherwise, the vibration arising from the drill may cause the work to shift downwards, with the result that the drilled hole becomes displaced from its true location.

As it is important that, for the sake of accuracy, the drill should run truly, it is better to centre it in the four-jaw rather than to hold it in the self-centring chuck.

It is certainly unwise to mount a large taper-shank drill in the mandrel taper, for the drive is then purely by frictional contact; and if the drill turns in its seating, the mandrel taper may be scored and rendered inaccurate for its legitimate purpose of holding the coned centre.

Taper-shank drills are furnished with a driving tang to engage a slot, specially formed at the upper end of the bore of the drilling-machine spindle.

Drills fitted to the drilling machine in this way, are removed by means of a wedge-shaped key, engaged in a transverse slot machined in the spindle.

In the case of the lathe, however, fittings with tapered shanks are best pressed out by means of a screwed bolt, fitted to the tail of the mandrel, to engage a rod inserted in the mandrel bore.

It may be pointed out that the ordinary lathe fittings, such as coned centres, have spanner flats or tommy holes to facilitate their removal,

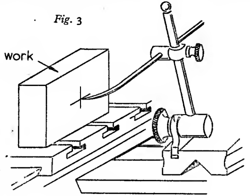
**Continued from page* 440, "*M.E.*," *April* 22, 1948.

and, on no account, should the hammer or the gas pliers be used for this purpose.

Drilling Work on the Saddle

In addition to using the tailstock for supporting the work, components may be clamped to the saddle and fed against the drill, mounted in the headstock, by means of the saddle traversing gear. This necessitates the accurate location, and the secure fixing of the work to the boring table, or in the lathe tool-post in the case of small parts.

Fig. 3



When setting up the work and clamping it to the boring table, a methodical plan should be followed so that the part is adjusted correctly in relation to the three planes in space in which an object can move ; that is to say in a vertical plane in relation to the lathe's centre height, and in two horizontal planes ; one in the direction of the saddle traverse, and the other controlled by the movement of the cross slide.

In addition, the component can rotate about the axis of each of these planes ; namely, the work can twist so as to lie obliquely across the lathe ; it can tip sideways, and it can tip backwards or forwards in relation to the headstock.

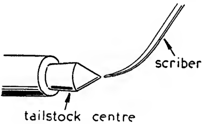


Fig. 4

Fortunately, the practised mechanic does not have to bother about these theoretical dry bones, as he relies on habit and on his engineering sense to guide him to put theory correctly into practice.

Nevertheless, when difficulties are encountered, due consideration of the underlying theory will, as a rule, quickly put matters right.

With apologies for this digression, let us turn to the practical side of setting-up the work on the boring table.

The first step is to adjust the work to the correct centre-height, and before this can be done the component must be provided with a flat surface so that it will lie evenly and not rock on the saddle, or so that it can be bolted to an angle-plate, fixed to the boring table, without fear of its tipping.

For the purpose of illustrating the methods used, the truly surfaced component shown in Fig. 3 may be taken as an example, and the problem is to drill a hole at the intersection of the cross lines truly at right-angles to the work surface.

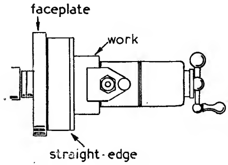


Fig. 5

A square resting upright on the cross slide, or on the lathe bed, will serve as a check to show that the front face of the work is vertical.

To set the horizontally scribed line to centre height, the scriber of the surface gauge is set against the point of the tailstock centre as shown in Fig. 4, the use of a magnifying glass will facilitate the operation. The surface gauge is then transferred to the work as illustrated in Fig. 3, and, if necessary, the component is adjusted to centre height by means of parallel packing strips, whilst thin hard card or paper can be used to obtain the exact final setting.

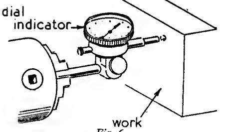


Fig. 6

The next operation is to set the work correctly across the lathe so that its face lies horizontally at right-angles to the lathe axis. This can be done quickly and conveniently by bringing the face of the work into contact with the lathe faceplate, or against a parallel strip or straight-edge interposed between the two, as shown in Fig. 5.

Should there be any difficulty in doing this, the work can be set by taking measurements with a ruler, or preferably with calipers

between the work surface and the faceplate.

A third and very accurate method is that illustrated in Fig. 6, where the point of the dial test indicator is engaged with the face of the work while the cross slide is moved backwards and forwards, and adjustments are made until the indicator shows a constant reading.

the surface gauge, is applied in turn to the upper and side surfaces of the centre finder.

Meanwhile, the surface gauge is moved to and fro along the lathe bed, with its register pegs in contact with the front bed shear, and the position of the work is adjusted until constant readings of the indicator show that the centre finder lies

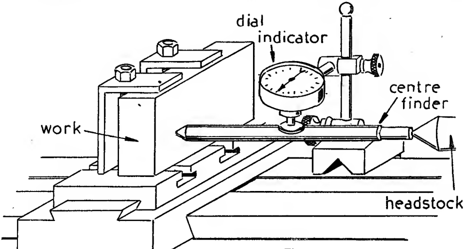


Fig. 7

truly parallel with the lathe axis in both the vertical and horizontal directions.

Reference to the initial theoretical statement will show that it only now remains to adjust the cross-slide setting to bring the vertical scribed line into the line of the lathe axis, in order to complete the setting.

For this purpose, the surface gauge can again be used, but, in this case, the register pegs on the under surface of its base are engaged with the front lathe shear when setting the scriber point to the tailstock centre.

The scriber point is then applied to the work, as illustrated in Fig. 3, and after the cross slide has been adjusted to align the work, it is firmly locked.

Where the drilling centre has been located by means of a hole drilled in the component with a centre drill, both the centre height and the setting of the cross-slide can be adjusted by means of the wobbler or centre-finder, as illustrated in Fig. 7.

In this case, a contact-piece with a flat surface should be fitted to the test indicator, so that uniform contact is made with the rounded surface of the centre finder.

The centre finder is mounted in the usual way between the tailstock centre and the work centre, and the test indicator, attached to the pillar of

A further method of setting the work is to fit a cylindrical peg into the pilot hole drilled to locate the drilling centre, and then to mount the test indicator in the chuck, as in Fig. 6, but with its contact point turned downwards as illustrated in Fig. 7. After the contact point of the indicator has been brought to bear on the centre peg fixed in the work, the mandrel is turned by hand, and the position of the work is adjusted until a constant reading of the indicator is obtained in all positions.

When the position of the hole has to be located with extreme accuracy, as when drilling and boring bearing housings to ensure the correct location of shafts carrying pinions, the work should be set by means of a toolmaker's button, as described in a previous article.

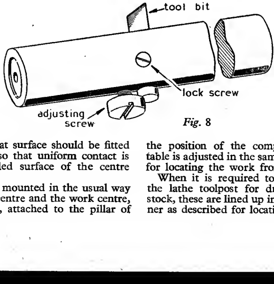


Fig. 8

When the button has been correctly set on the work, the position of the component on the boring table is adjusted in the same way as that described for locating the work from a cylindrical peg.

When it is required to mount small parts in the lathe toolpost for drilling from the headstock, these are lined up in exactly the same manner as described for locating work on the boring

table, but in this case the top slide should be firmly locked, as well as the cross slide.

Setting the Vertical Slide

Before leaving the subject of setting the work, reference should, perhaps, be made to the methods used to align the vertical milling slide when mounted on the boring table of the lathe.

In the first place, the slide should be set so that it moves in the truly vertical direction when it is required to drill holes, or machine work, at right-angles to the upper surface of the boring table. In the case of a swivelling vertical slide, this can readily be done by feeding the table downwards until its lower edge comes into contact with the lathe bed, or with a parallel strip supported on the bed ; the bracket pivot-bolt is then locked.

The slide is set truly across the lathe axis by either of the methods already described for setting the work, and as illustrated in Figs. 5 and 6.

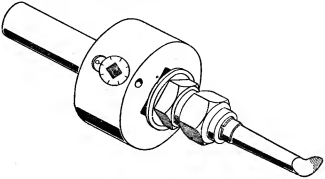


Fig. 10

Fig. 9

Setting a machine vice attached to the vertical slide is carried out in the same way, that is to say the fixed jaw of the vice is set horizontally by means of the test indicator mounted in the chuck, or on the pillar of the surface gauge, as shown in Fig. 7.

The setting is made by adjusting the position of the vice on the machine table and not by tipping the slide, otherwise the true vertical setting of the slide will be lost.

When the vertical slide is set truly across the lathe axis, the vice, if accurately made, should, of course, also be correctly aligned in this direction. It will be apparent that parts held in the vice mounted on the vertical slide, can readily be adjusted to the lathe centre-height, and, here, again, the slide should be firmly locked after the final setting has been made

Clamping the Work

As each piece of work will present its own problem, dependent on its size and shape, when it comes to securing it to the boring table, it is not possible to offer more than a few general suggestions.

In the first place, some consideration might, perhaps, be given to the theoretical side of the problem, for clamps, or constraints as they are called by the instrument designer, are applied to the work to prevent its movement in any of the directions possible. Clearly, the only impossible movement, before the work is clamped to the boring table, is in a downward direction, and all others must be taken into account when securing the work.

When clamping work to the boring table, great care must be taken not to distort it either by the use of undue pressure, or by applying the clamping devices where the metal cannot resist the strain imposed. If the work is distorted in this way while being machined, it may regain its former shape on being released, and the machining will then be inaccurate.

Drilling

When it comes to the actual drilling, a centre drill, truly mounted in the four-jaw chuck, should be used to form a start for the drill, if this has not already been done.

The centre drill is followed by a pilot drill, and larger drills are used in succession to bring the hole up to the required size, as has been described in connection with drilling from the tailstock.

To feed the work to the drill, the lathe saddle is traversed either by using the automatic feed, or by turning the leadscrew by means of its handle. If a feed, finer than can be readily obtained by the latter method is required, a 60-tooth wheel should be attached to the leadscrew, and a 20-tooth wheel geared to it is mounted on the quadrant ; a large wheel with, say, 55 teeth is placed on the outer end of this stud and, when secured to the 20-tooth wheel, it is used to turn the leadscrew by hand at a greatly reduced rate.

When the hole has to be accurately formed as to size and location, the drill should be followed by a boring tool, and it will then be necessary to provide some means of adjusting the tool for the exact sizing of the bore.

For this purpose, either a boring bar, or a boring tool, or adjustable boring-head can be used.

If the structure of the work and the method of clamping allow, a boring bar can be mounted between the lathe centres and driven from the headstock.

The usual method of providing a means of adjustment of the tool-bit in a boring bar is illustrated in Fig. 8, where it will be seen that the tool is clamped in place with a lock-screw after it has been set by means of the adjusting screw.

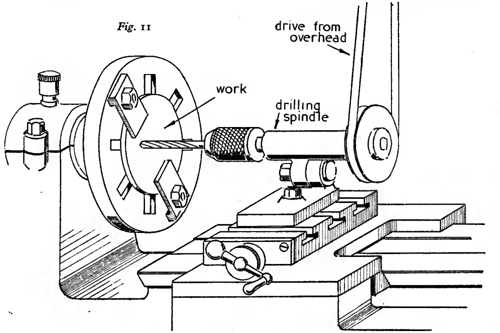
It should be noted that the latter screw also prevents the tool bit being pressed out of adjustment when in contact with the work during the boring operation.

mounted in the four-jaw chuck and adjusted, as in the previous examples.

The setting of the tool is greatly facilitated when an adjustable boring-head, the Garrard for example, is mounted in the lathe headstock.

This device, which is illustrated in Fig. 10, is fitted with a feed screw of 40 threads per inch, carrying an index graduated in thousandths of an inch. The tool can readily be changed, as it is carried in a split collet compressed by a threaded cap-nut. After an adjustment has been made, the tool slide is secured by means of a locking-nut.

Fig. 11



To operate the boring bar, a light cut is taken through the bore, and the bar is then removed to enable the diameter of the hole to be measured with a micrometer, taper gauge, or calipers.

After the bar has been replaced in its former position between the lathe centres, the dial test-indicator, mounted as in Fig. 7, is used to take a reading against the tool's cutting edge as the mandrel is turned slowly by hand in a backward direction.

The throw or radius of the tool can then be adjusted so that in one or more stages it will remove the required amount of metal to bring the hole to size.

Another method of setting the tool for the final sizing operation, when it is not adjusted radially in the bar, is to engage one end of the bar with the tailstock centre and to secure the other in the four-jaw chuck; the chuck setting is then altered with the aid of the test indicator to adjust the tool point, as in the previous case.

When the bar is mounted in this way, it will be necessary to disengage the tailstock and to rack the saddle back in order to measure the diameter of the bore.

Where a bar cannot pass through the work, a small cylindrical boring tool with inset cutter, such as the Nulok illustrated in Fig. 9, can be

Drilling from the Saddle

When drilling a series of holes on a circular path, as in making a division plate or drilling the bolt holes in a cylinder cover, a drilling spindle can be mounted on the lathe saddle and set to the exact radius required by means of the cross slide.

A device of this type is illustrated in Fig. 11, and it will be seen that some form of independent drive is required for its operation. This is usually provided by means of a belt from the overhead drive shaft, or, if this is not available, the drive can be taken from an electric motor mounted on the bench for the purpose. In some cases, these drilling spindles are driven by a flexible shaft drive coupled to a nearby motor. The feed for the drill is provided by the saddle traverse, as already described.

As an alternative to the use of a drilling spindle for this purpose, the writers mount the head of a small sensitive drilling machine on the lathe saddle by means of a short length of steel bar, of the same diameter as the drill pillar, secured to an angle bracket bolted to the boring table.

(*Continued on page* 483)

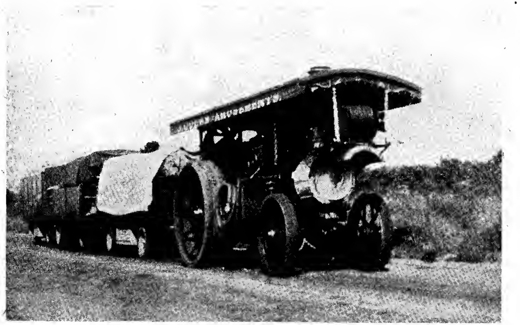
Traction Engine Hunt Continues

by W. Boddy

YOU know, the steam traction engine may be rapidly dying out; yet, if you search the rural areas, it is really surprising how many you can unearth. I described and illustrated a few of the engines I had discovered soon after I decided to hunt them, in THE MODEL ENGINEER dated July 31st, 1947. Having exhausted quite a number within a short distance of home, I came to the conclusion that, while film and petrol were available, I should probably have to concentrate on steam-wagons, stationary engines, and narrow-gauge locomotives, for my photographic excursions in search of steam. Not a bit of it! Traction engines continued to crop up all over the place.

engines seemed to be in a state of reasonable preservation.

This discovery merely whetted my appetite, and I hadn't long to wait. Beside the Farnham-Winchester road one evening I espied a bulky tarpaulin-shrouded shape beside a water standpipe. Smoke issued from a protruding funnel. Returning next day, I traced this engine to a nearby farm, where it was waiting to commence threshing. Owned by Vale Farm, of Pitt, near Winchester, this was a Burrell Road Loco in truly beautiful condition, taxed, and proudly bearing the name *The Marshal Foch* on a plate on its smokebox door. Its number was 3849 and Mr. King, its owner, was very ready to talk about



A fine Burrell owned by J. Cole's Amusements climbing up on to the Hog's Back

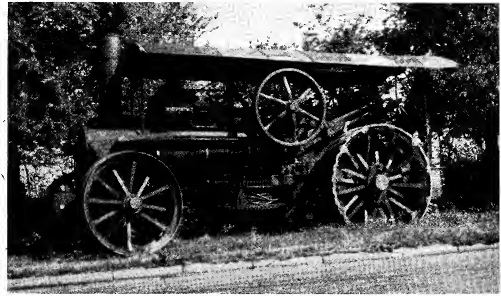
For a while, I admit, things were pretty slack, if one overlooks a partly-dismantled Fowler just outside Winchester. Then, diverting one day from my usual route from Hampshire up to London, I caught sight of two engines standing in a field near Shepperton. Both were of showman's-type and the larger of them bore the name *Demolicious* and carried a plate announcing that it had been taxed by the West Sussex County Council on May 25th, 1920. It was a Fowler (No. 16916), and its fellow was a smaller Fowler, which weighed under 13 tons and had also been taxed for road work in its day. Both

traction engines in general. Indeed, he sent me off in the Austin to see a distant relation of his, on a farm at New Arlesford, who was said to be quite a traction-engine enthusiast. This gentleman was out, but I met his two sons, busy repairing a fence in one of their fields, and, although they had a Fordson with them, they certainly remembered the old days of steam. Their father had used Fowlers and Burrells and still had one old Burrell. "They used to tow a cart-full of ladies on Women's Institute treats," I was told. "There was a bit of a do sometimes, because the cinders used to set the ladies'

hats on fire, if the driver were a trifle careless."

It was during conversations such as these, with farmers and showmen who were willing to recall the days before petrol and diesel-engined vehicles came to rival steam, that I picked up facts and figures which, pieced together, told me not a little about the engines I was hunting. How the modern-type of traction engine dates from a design of the late Mr. Aveling, introduced in 1870, and how his three-shaft transmission was in general use until about 1890, when the majority of manufacturers went over to four-shaft engines, with most of the gearing inside the bearings, a layout which Aveling had pioneered in 1878. I learned that Burrell continued to build three-shaft engines until they ceased production in about 1929, and that Wallis and Steevens, and Green, also made this type well after 1890. It was pleasing to discover that some of the old iron boilers lasted fifty years or more in districts where the water was kind to them, and that cast-steel gearing, first used around 1876, has been known to function for something like forty years, albeit becoming very slack in the process. Hints useful in dating different engines came to light. Thus, machine-cut steel gearing did not come into general use until about 1924, while steel boilers and fireboxes (the average life of a firebox seems to be ten or twelve years) were mostly unknown before 1890. Road springs and compounding seem to have arrived about 1887.

As early as 1879, J. and H. McLaren provided two-speeds and a water-lifter as standard accessories, and this resulted in universal adoption of what were formerly listed as "extras." As I probed more deeply into the subject I found that governors often fix the approximate age of an engine. The high-speed, cross-arm governor is usually post-1880, while direct-acting Pickering governors were introduced by Burrell about 1905, and by Clayton and Shuttleworth in 1909, while Ransomes, Sims and Jefferies used a Gardiner governor from 1911, after having employed a pendulum type since about 1862.



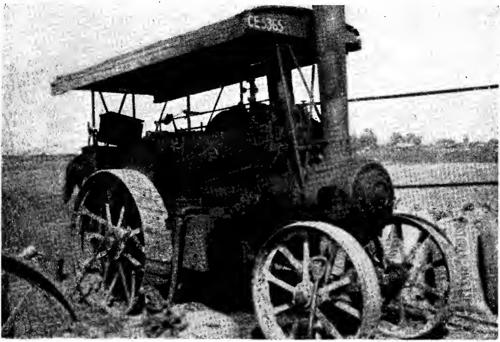
A really vast Fowler ploughing engine (No. 16719) photographed beside a main thoroughfare in Surrey last summer

Apparently Wallis and Steevens brought out an expansion-gear about 1895, to obtain economy of operation without the expense of compounding, while McLaren appears to have pioneered the fitting of an oil-pump, for piston and slide-valve, instead of the less-dependable displacement lubricator. W. Fletcher designed an agricultural Ransomes, Sims and Jefferies in 1892 which, except for minor changes, was still in production in 1934; as on an Aveling and Porter, he placed his feed-pump on the off-side of the boiler. Unlike Ransomes, Fodens dropped traction engines in favour of steam wagons in about 1907. The circular, bored cross-head guide, in place of slide-bars, was pioneered by Marshall in 1880.

Most of those with whom I discussed their beloved engines agreed that 1895 to 1910 was the heyday of the steam road-locomotive, after which petrol ousted steam except for really heavy haulage work. This being the case, I congratulated myself on finding so many engines still about, even if I had not discovered any really "veteran" ones. Many of my "finds" have been showmen's locomotives, of which an encouraging number are still in active service. In a yard off the Great West Road, down by Hook, I espied the Burrell Patent Engine *King Edward VIII* (No. 2894) owned by Harris's Super Amusements. A fair occupying a field on the London side of Staines produced two

immaculate Burrells, the immense 11¼-ton *Lord Fisher* (No. 3694), owned by S. Beach's Amusements of Southall, and Miss Beach's far smaller 6½-ton *May Queen* (No. 3497).

Only a few miles from my home are two showmen's depots and here I found, not only two rather forlorn, partly-dismantled engines, but the Burrell *Dreadnought* (No. 3211), last taxed in 1946, hailing from Petersfield and weighing 11 tons 14 cwt. unladen.



The type S.C.D. Ruston and Proctor, "The Lincoln Imp," engaged in driving farm machinery

Perhaps, however, my best "find" in this direction was that at a fairground situated behind Farnham Castle at the top of the steep, winding hill out of that town. Here J. Cole's Amusements were in full swing and they were lit by a magnificently-kept Burrell (No. 3483). Chatting to its delightfully-begrimed driver I learned that this engine was of about 1927 vintage and one of three still in use.

It had, it seems, cost £2,500 new, and Burrell's still supplied parts for it, but nowadays you had to wait for them, whereas before the war they had operated a prompt, country-wide servicing scheme. This fair was moving off early on the morrow for Epsom. So we rose early and hurried off in the Austin Seven to see it leave. We arrived too late, so we set out to catch up with the engine and its train of vans. It was overtaken at the long climb up on to the Hog's Back and we watched it pass after we had parked at the top. Puffing mightily, its brasswork gleaming in the sun, it was a fine sight, even to the very aged man unconcernedly perched on a plank at the back of the last van. Having gained the summit, it paused for a moment, probably to change gear, and the little saloon cars that had been unable to overtake, shot round it with relief—we confess we had half-expected to see a G.N. or other early cycle-car emerge from behind the Burrell's ponderous bulk. . . . Not far from it, incidentally, stood another of its kind—a vast Fowler Ploughing Engine (No. 16719), taxed to the end of 1947 (for 5s. delightfully enough!) and presumably now used by the local council for road repair work, as a similar Fowler was later encountered in a council-yard at Caversham.

Road locomotives usually have three speeds, giving 2, 4 and 6 to 8 m.p.h. or thereabouts, respectively. They are rated by "nominal" h.p., a system as old as the oldest traction engine, but the larger engines haul loads of 45 to 50 tons comfortably. A popular tyre size is 160 for 850 on the front wheels, 120 for 880 on the rear, and I have noted both Dunlop and Henley tyres on the engines I have found.

Compound engines are more economical of fuel and water than simples for haulage, and are also quieter and smoother in starting. Some drivers prefer a pump and injector to two injectors, saying that with a pump they can reduce boiler-pressure more quickly if the safety-valves blow off in traffic and that it works with less noise. Asked if police cars ever bothered him, one dear old chap admitted that his Burrell could get along at 20 m.p.h. if he let it; obviously he loved his beautifully-maintained engine, and there is nothing unusual in that. The biggest

difficulty at the moment seems to be getting enough coal. One engine I saw had its supply in an army lorry beside it.

Pleasing as it has been to encounter these showmen's locomotives, I have gained equal pleasure from finding traction engines still in use in othe spheres. Quite by chance, when the camera wasn't in the car, I came upon a very spick-and-span Aveling and Porter owned by the Metropolitan Water Board. I gathered that it is a 1907 model or thereabouts and it is employed in hauling a rubber-tyred truck in and around the Sunbury Water Works, for which purpose it carries a road-fund licence, as it negotiates portions of the public roads in the course of its duties. Shortly afterwards a Garrett towing farm implements was seen on the Oxford Road.

The Burrell road locomotive, " The Marshal Foch," working on a Hampshire farm

Then, going out to inspect the old hill at South Harting where cycle-cars, and later racing cars, used to deport themselves years ago, we heard a puffing behind a haystack and, climbing up a bank, came upon a small traction engine driving a whole collection of farm machinery. It turned out to be a Type S.C.D. Ruston and Proctor (No. 52579), built at Lincoln and delightfully named *The Lincoln Imp.* It had been taxed as recently as 1946 for road travel. Incidentally, further conversation revealed that single-cylinder engines are usually employed for threshing, because they govern better than compounds, at low boiler pressures. Another piece of information was that disc-type flywheels were introduced for road locos. in place of the spoke-type, as less likely to startle passing horses.

One could go on for pages about this fascinating subject. Suffice it to say that in a fairly casual search, lasting about six months and confined to a radius of about thirty miles, I have unearthed examples of nine different makes—Wallis, Ransomes, Garrett, McLaren, Fowler, Foster, Burrell, Aveling and Ruston. I confess I should like to find examples of Clayton, Mann, Little Giant, Marshall and Foden. After which I shall become *blasé* and only photograph engines built before 1900 . . . !

In the Workshop

(Continued from page 479)

This arrangement has the advantage that the drilling machine's sensitive lever feed is available, and the drilling operation is then more easily carried out than when the saddle traverse gear is used to feed the drill; this is especially noticeable when very small drills are used.

When drilling in this way, a small centre drill should always be used as a preliminary, and this is particularly important where long slender drills are employed.

Before taking leave of the subject of drilling in the lathe, it should be mentioned that the difficulty, due to internal friction, that sometimes arises when the tailstock is used to feed the drill may be overcome by fitting a tailstock with lever feed. This device gives a sensitive feed and is most useful when the quantity drilling of small parts is undertaken.

Furthermore, it is not usually possible to run the lathe at the high speed required for very small drills held in the tailstock, but the necessary speed can be obtained by fitting an independently-driven drilling spindle to the barrel of the tailstock itself, and, in this case, a lever mechanism is incorporated to give a sensitive feed.

In connection with the foregoing remarks, it may be pointed out that both lever-feed adaptations to the existing tailstock, and high-speed drilling attachments for the tailstock have been described in THE MODEL ENGINEER.

A New Use for Old Pistons

by J. G. Slender

DURING construction of a single-acting steam-engine, it was necessary to fit up a small countershaft to drive an end-mill for cutting out the inside of the piston. On looking round the workshop for some suitable brackets to support the shafting, I hit upon the idea of using two scrap motor-car pistons.

To make the brackets, look neater, it is suggested that the gudgeon-pin boss which is not used could be cut off at about 45 deg. and then dressed up to blend in with the base and the other boss.

The brackets proved so successful in use, that the idea was extended, and a small bench grinder

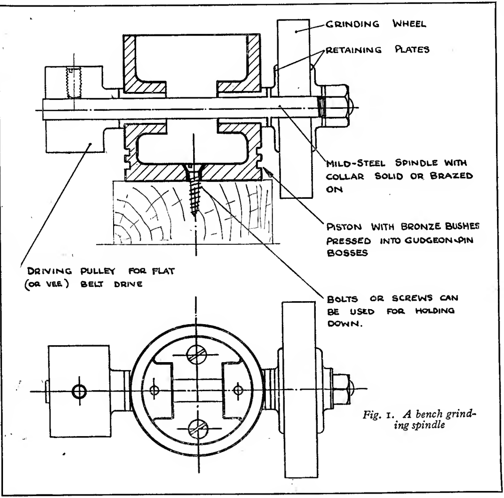


Fig. 1. A bench grinding spindle

Two bushes were bored to suit the shafting and then turned on the outside a push fit in the gudgeon-pin boss of the pistons, and one bush was fitted to each piston. The crown of each piston was drilled for the holding-down bolts; and, before finally bolting down, a rubber heel was inserted under the piston to prevent undue noise and vibration being transmitted to the wall, as shown in Fig. 2.

was made up using another piston. Two bronze bushes were turned up and pressed into the gudgeon-pin bosses. A long ½-in. bright bolt was obtained, the head cut off and a collar was brazed on to form a shoulder for holding the grinding wheel on, and then lapped into the bushes. A pulley was turned up and held on with a grub-screw. The retaining plates were made from large washers and a carborundum

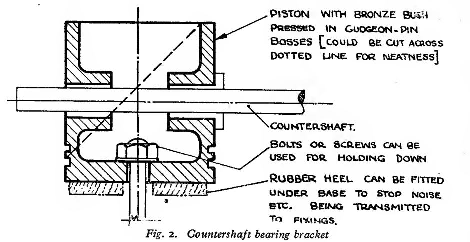


Fig. 2. Countershaft bearing bracket

wheel was bought. The base of the piston was drilled and countersunk for two wood screws, and was screwed to a wood packing-piece to bring it up to the desired height. The spindle, washers, wheel and pulley were all assembled and quite a neat and very useful little grinding spindle was the result. (See Fig. 1.)

Another very useful and simple milling spindle made on similar lines for use on the lathe top-slide for end-milling is shown in Fig. 3. This was made from an old Austin "7" piston and it will be seen from the drawing that no chucks, etc., are required to hold the "D" bit or cutter, the actual cutter being formed direct on the spindle.

The piston was drilled in the crown for holding-down bolts, and bronze bushes were turned and pressed into the gudgeon-pin bosses. A piece of silver-steel was obtained and the cutter formed on one end, then hardened and tempered. A thrust collar and pulley was turned up and the bushes in the piston were lapped out to suit the spindle (a good fit here is essential) and the whole lot assembled. When it is necessary to change a cutter, merely slack off the grub-screws holding pulley and thrust collar on and remove the combined spindle and cutter, and fit a new one of the size required.

I have refrained from giving dimensions, as these will vary according to pistons obtained and material available at the time.

The brackets, etc., made in the way described are all very strong, light, simple to make and cheap ; any local garage will be only too pleased to give you as many pistons you care to ask for. Be sure to use the ones with a flat top for ease of bolting down.

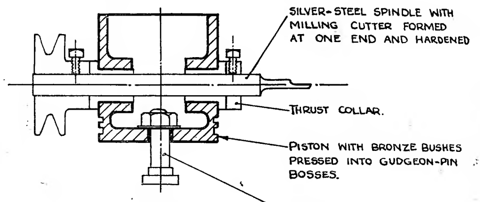


Fig. 3. Milling spindle for lathe top slide

" L.B.S.C.'s " Lobby Chat

What will be the future of B.R. Locomotives ?

As I have not yet finished the valve gear drawings for the " Maid of Kent " and the " Minx "—you would be surprised to know how long these jobs take nowadays ; *anno Domini* takes its toll !—let's have another five minutes in the lobby, and talk about subjects of mutual interest. Several correspondents have written about the locomotive exchange now taking place between the various regions of British Railways, and speculation seems rife about what the ultimate outcome will be. Some think that one particular group of engines, such as those of the erstwhile L.M.S., will be adopted for the whole of the country ; and others are of the opinion that each region will—as in the days when they were separate companies—use special engines of their own design, for the particular road they run on, arguing that locomotives suitable for the galloping-ground between Paddington and Swindon, would be out of place on the fearsome grades of the single lines in the North of Scotland.

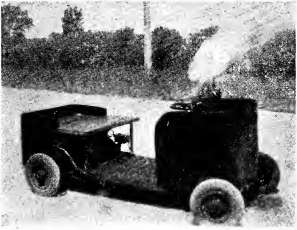
In my own humble opinion, it will work out as a combination of the two. When you come to think of it, the present-day engine, whoever designed it, is really the combined product of the brains of all the locomotive engineers from old Billy Murdock, who scared the village parson out of his wits with his " live steamer " on the churchyard path, through the Victorian era of Sturrock, Cudworth, Fletcher, the Stirlings, the Drummonds, the Billies (Dean and Stroudley) and other old stalwarts, to the days of Churchward, Gresley, and those well-known personalities who are still with us. That being so, it doesn't need a Sherlock Holmes to deduce that the logical outcome of the present exchange of locomotives, will be a sorting-out of the good and bad points in every engine, and the former incorporated in some complete new design ; or else the best of the existing designs will be adopted, and have added to them, the good points of those that are discarded.

If my first name happened to be Elijah, which it isn't, I should venture to assert that the fastest and heaviest passenger services on all roads will be hauled by four-cylinder " Pacifics " similar to the L.M.S " Duchesses," but with a dash of L.N.E.R. incorporated in their make-up ; equally fast but lighter trains will be handled by a type similar to the G.W. later " Castles," but with three cylinders only. For general all-round passenger work, the L.M.S. Class 5 will reign supreme, with maybe a few modifications in detail. The 4-4-0 will probably disappear altogether, light fast passenger services being worked by small 2-6-0 mixed-traffic engines similar to the new 2F's of the late L.M.S. The small-wheeled three-cylinder " Loch " class 2-6-0's of the L.N.E.R. will prove their worth for climbing " yonder Grampian mountains " and " ye banks and braes o' bonny Doon," or I miss my guess. Two classes of tank engine will handle all suburban and short distance work ; a 2-6-4 heavy and 2-6-2 light, each type being a composition of L.M.S., L.N.E.R., and G.W. practice.

For heavy mineral and freight traffic, the only engine that could beat the L.M.S. 8F (Beyer-Garratts excluded) would be a ten-coupled " Ada " with bigger cylinders ; so we might include the 8F in our list of B.R. engines. A medium-powered 2-6-0 such as a combination of the L.M.S. 5F and the Southern N could undertake all the intermediate work, the light jobs being performed by the small mixed-traffic engine mentioned above. A small 0-6-0 tank such as the latest G.W.R. 9400, or the L.M.S. " Molly," could take care of short hauls and shunting ; and a little light short-wheelbase 0-6-0 for docks, factory sidings and so on, would about complete the list.

When the tests of the various engines are all complete, and the " powers that be " come to weigh up the various good and bad points of each class, it is pretty safe to assume that simplicity, reliability, economy of fuel consumption, and robustness of construction (which means long service without repairs) will score the highest marks ; and I don't have to mention by name, two particular types of locomotives that are going to fall down pretty badly on all four counts ! And although, as I said above, my first name isn't Elijah, I'm going to " chance the ducks " and make two definite prophecies. No. 1 is, that " unit construction " will be adopted in new designs ; so that a valve-gear, for example, can be built up complete on a small frame, and erected on the engine in such a manner that a worn or damaged one can be removed " lock, stock, and barrel " and replaced by a new or reconditioned unit in a single night, without taking the engine out of service. No. 2 is that the person who has the best first-hand knowledge of exactly what is wanted, to wit the driver, will have a big say in the design of any future class of engine. Messrs. Churchward and Maunsell, to mention only two names, made friends with their drivers, and ascertained their views on many points of design, construction and operation ; if Francis Webb had only done the same, the locomotive history of the L.N.W.R. might have proved a real thriller ! If I were C.M.E. of the B.R., I would make an innovation which would not be very expensive, but would well repay even its small cost ; and that would be to instal a little continuous line of about 1,000 ft. length, and $3\frac{1}{2}$-in. gauge, at Crewe, Derby, or any other convenient place. It would include curve and grade corresponding to the sharpest main-line curve and steepest main-line grade on the system. Any new design could be built to one-sixteenth full size, at very small cost ; just the plain job, with " scale " boiler, cylinders, and so on, same as I would build one for my own

little road. The little engine could be tested out under service conditions with varying loads, and valuable comparative data obtained; not only that, but senior drivers from various sheds on the system, could be invited to see the little engine, criticise it, and try it for themselves. They would get a far better understanding of a new design, or improved existing design, from seeing the engine "in the flesh," so to speak, even in the small size, than they would get from studying a set of blueprints and hearing explanations. Suggested alterations and improvements could be carried out at small cost; and anything that proved to be no good, could easily be scrapped or altered. Finally, when the engine had served its purpose, it could be preserved for historical or any other purpose, and would be far more valuable than any drawing or records of the usual type.


Mr. McLellan's passenger-carrying steam car

Concluding this little friendly chinwag about the B.R. engines, in being and "in the air," some of the before-mentioned correspondents wanted to know how the Southern engines would fare on the Northern lines, having no water-scoops on their tenders; and how the Northern and Western engines would manage, as the Southern have no troughs, or "track pans," as our cousins over the big pond call them. Simple enough; at the time of writing, tenders are being swapped on the exchange engines, the Southern locomotives having L.M.S. tenders temporarily fitted to them, and vice versa. Many people interested in locomotives, apart from our own fraternity, are intrigued with this exchange business, and the results will be awaited with great anticipation; but I'd bet my last dollar (if I had one) that the "choicest" bits of information regarding actual performances—that is, failures, and how and why of same—will never be known outside the charmed circle. There is one thing that I hope I shall live long enough to see, however; and that is, a third rail or an overhead wire on Bromsgrove Lickey. Steam is, and to the end will always be my favourite; but I never fail to give credit wherever due, and there are some things "Milly Amp" can do better than "Old King Coal" ever could by "direct action." When I stand by the Lickey for the last time, I hope to see a triple-unit "Milly" silently glide up behind her steam sister's train, and help it to the top of the bank with no fuss and no apparent effort. To see "Big Emma" or a couple of "Mollies" doing the job is an impressive sight, but it reminds me of a heartless carter mercilessly thrashing a poor struggling horse trying to drag a heavy cart up a steep hill, and it makes me feel queer. The change could easily be made; and if any official of the B.R. reads these notes, and has power to "pull the strings" for the early electrification of Bromsgrove Lickey, I hope he will act. In any case, it would be a proposition covered by that blessed [??] word "economic."

A Baby Steam Car

Followers of these notes interested in small cars intended for real work—not the racing type that run around poles and small editions of Brooklands by our i.c. friends—will be tickled by the reproduced photograph of a tiny passenger-carrying steam car built by Ken McLellan, of Christchurch, New Zealand. Mr. L. E. Walcot-Wood, who kindly forwarded the picture, says it has a vertical coal-fired boiler, and two of his No. 1 stationary engines with cylinders 1 in. bore and 1 in. stroke. The crankshafts are geared to the back axle through a three-speed gearbox, the top speed being four-to-one. On the open road, timed by an ordinary car fitted with a speedometer and running parallel, the little car knocked up 15 miles per hour with two adults on board. Mr. McLellan is a garage proprietor, but also makes machine-tools, including a drilling-machine of which Mr. Wood speaks very highly.

Fluorescent Lighting—Is it Harmful?

A Nottingham reader who installed a fluorescent tube in his workshop, says that he, like myself, was well satisfied with the change, but after some time began to suffer from considerable eye-strain. He also found that his vision in ordinary lighting in other rooms of the house began to get clouded, and the same effect prevailed in ordinary daylight outside. He began to get alarmed and feared all sorts of things, until his wife suggested that it might be due to working under the flu' tube; so he reverted to ordinary lighting, with the result that in a few days his sight began to improve, and is now normal. He wondered if I had suffered any sight trouble, which might have been caused by the light without my suspecting it, and kindly sent his own experiences as a help in the matter; also says he has heard of others having had a similar experience.

I'm glad to say that I have had nothing but benefit from my own light, and not only can work better, but have got rid of one small trouble

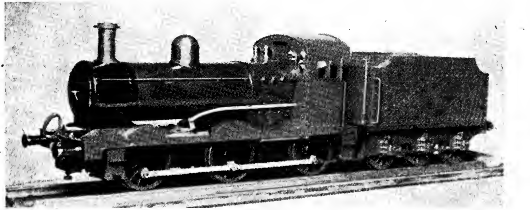
that used to be a bit of a nuisance; that is, watering eyes. Sometimes in late evening, after a long spell at bench and machine, the "distillation department" would suddenly decide to put in a bit of overtime, and tears would run down my face. This trouble gradually ceased after installing the new light, though I still get it occasionally when doing a long spell of writing and drawing, both by ordinary "pearl" lamps or by daylight on a summer evening. It is due to the non-stop reflection of the white paper, to my way of thinking.

I am now wondering if it was the position of the tube, in relation to our friend's bench and machinery, that caused his trouble, and whether the rays struck directly into his eyes. Years ago, I was warned by an oculist friend, that if I wanted to keep my eyesight good for as long as Nature would allow, never to let the rays from any artificial light, nor even from the sun, strike into my eyes direct. He advised the use of an eyeshade and I always use one, both for working at bench and machine, and for writing and drawing. Before installing the flu' tube, I had to look very intently at small work, which was very likely the cause of the watering, and would explain its disappearance with the more powerful light. Maybe our friend used a "daylight" tube; this suits me fine, but it may not suit him, and perhaps if he used a warm white tube, he could return to fluorescent lighting without any more ill effect. It is also just possible that his trouble was more apparent than real; as everyone knows, if a strong light catches you, such as a car headlight, or even the sun's rays, everything else appears dull by comparison, The powerful light of our friend's flu' tube may have caused other lighting apparently to become duller and clouded; and now it is out of action, ordinary lights appear brighter and clearer again. I see no reason why artificial daylight should be any more harmful than natural daylight.

"Molly" as a Tender Engine

When describing how to build a $3\frac{1}{2}$-in. gauge L.M.S. 3F tank engine some time ago, I mentioned that if anybody preferred a tender engine to a tank, they could easily convert "Molly" to a tender engine by shortening the frames, fitting the usual open-backed cab, and building a tender by enlarging one of my $2\frac{1}{2}$-in. gauge tenders, such as specified for the "Olympiade," in the proportion of 5 to 7. Several readers carried out this variation with satisfactory results; and a picture of one of the engines is shown here. She was built by Mr. K. Armytage, of Cranleigh, Surrey, and performs in the manner usually observed among "Live Steamers," hauling her owner and several passengers with ease.

Mr. Armytage is an ingenious workman, and sent me a novelty in the shape of an old-fashioned brass cannon, reminiscent of the days of Lord Nelson; not the eight-beats-to-a-turn one, but the gallant old boy who gave the French fleet a few beats over the eight, and, alas! sacrificed his own heart-beats in the process. The little cannon looks very realistic, mounted on a "period" stepped wooden carriage, with brass wheels, breech cap, lanyard and all complete; but it is far from being a lethal weapon, for instead of "putting anybody's light out" it is intended to provide them with one! Just below the breech cap is a little knurled wheel with a flint below; and removal of the cap, by pulling the lanyard, reveals a lighter wick, the fuel being carried in the barrel of the cannon. The little novelty works perfectly.



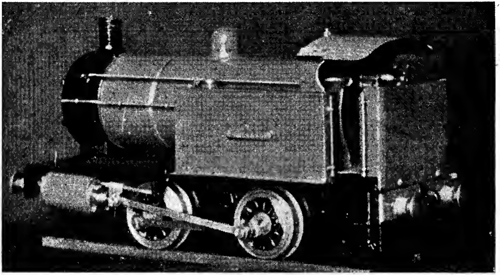
Mr. K. Armytage's "Molly" with a tender

"Baby Juliet"

Another popular job was the gauge "1" edition of the simple 0-4-0 tank engine "Juliet." From what our advertisers tell me, there was a proper "rush" on castings and material for this tiny engine, and reports have come to hand from various correspondents who built her, saying that their engines did all I claimed, and a bit extra for luck. The photographs reproduced here, show a typical example of the finished job; she was built by a member of the Bradford club, Mr. J. K. Scarth, who says she maintains 60-lb. pressure, and goes like nobody's business. He is building a six-coupled job to the same gauge, based on the L.M.S. 2F tank engine (similar to Mr. L. T. Truett's big one) using two

cylinders $\frac{9}{16}$ in. by $\frac{3}{4}$ in., spirit-fired boiler similar to the little " Juliet," and mechanical lubrication. He wants to experiment with a gauge " 1 " injector. It would work all right, but the trouble is, to keep the weeny-weeny cones clear of dirt and scale ; for in that size, the slightest obstruction in the throat of the delivery cone, or a speck of dust on the seat of the air-valve, would put the little jigger *hors-de-combat,* and thereby hangs a tale.

valves, and the injector, after one or two preliminary splutters, started, and filled up the boiler. I took the engine around for a mile or so, blowing off with the firehole door open, not putting any more water in the boiler, so that it dropped to half a glass, and then invited my visitors to " have a go," as Wilfred Pickles would say. They did, and promptly derailed the whole outfit at the south curve. As there was a good fire on, the boiler was blowing off furiously by the time we got it all on again ; steam was still blowing from the injector overflow, and this time when I opened the steam and water valves, the injector started, but dribbled badly and didn't put much water in. Anyway, to cut a long story short, my visitors got the hang of riding the flat car properly, and did a few laps each, but they didn't drive the engine like I do, and managed to use plenty of water, so it remained near the bottom nut. After a while I took the regulator again, did a few fast laps, and finished the test with some live cinders on the bars, half a glass of water, and 40 lb. on the " clock."



Gauge " 1 " " Juliet " by Mr. J. K. Scarth

Pride Goeth Before a Fall

" Tugboat Annie " let me down the other afternoon—at least, it wasn't exactly the lady herself, as she performed in her usual manner, but the little injector ; and the only party to blame for that, was your humble servant—I plead guilty, so please be merciful ! This is how it came about. The injector has never given a scrap of trouble, running or standing, since I first fitted it soon after the engine was built ; I usually work both pump and injector alternately, when running, to keep them both in good fettle. " Annie " was at work on the evening of Easter Monday—much to the entertainment of homeward-bound holiday passengers in the trains on top of the bank, many of which were either slowed to a crawl or stopped entirely by signal, right opposite my little railway, owing to the congestion of traffic in the London area. After nearly three miles' run, " Annie " naturally got a bit oily (that Cyltal 80S really does stick, as I have mentioned before) and as I wanted her to look smart on the Tuesday, thought I would clean the " works," and turned her upside down on my bench, to get at " the underneath."

On getting up steam on the Tuesday afternoon, steam began to blow from the injector overflow, and the only place it could come from, was the delivery clack. Anyway, as soon as she made enough steam, I opened the water and steam

After my visitors departed, I took off the little jigger, only a few seconds' work, and found the thing full of grit, some of which was stuck tight on the seatings of both clack and air balls. I cleaned the whole doings thoroughly, reseated the balls, and replaced the gadget ; and after tea, got up steam again and did nearly three miles, finishing the run after darkness had fallen. The injector worked perfectly, running and standing ; boy, *did* I feel sore ? I might have known, when I turned the engine upside down on the bench, that any scale or grit at the bottom of the boiler barrel would naturally get stirred up, and go to the " inverted top " ; and as " Annie " has top-feeds, it was obvious that some of the stuff would get into the top-feed pipes, which is exactly what happened.

*Swords into Ploughshares

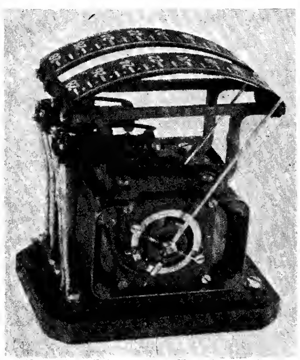
Hints on the adaptation of "surplus" war material for model engineering or utility purposes

Electrical Measuring Instruments

by " Artificer "

SEVERAL readers have asked for advice on the adaptation of electrical measuring instruments, many types of which are available on the surplus market. In addition to those which are calibrated in electrical terms, there are many others in which electric currents are used only for the translation of other measurements, such as temperature, pressure, engine speed, etc. A number of such instruments have already been briefly referred to in these articles. In the great majority of cases, these instruments, when not required for their original purposes, may be converted and re-calibrated to serve as sensitive galvanometers, voltmeters, ammeters, etc.

The types of instruments which have electrical calibrations can usually be applied to general work without any alterations whatever, unless it is necessary to alter their range of working, but some knowledge of their principles of operation, and care in handling them, is desirable to get the best results from them and avoid damaging them. A delicate instrument can be ruined in a matter of seconds by carelessness or ignorance in handling. For instance, a case was recently encountered where an experimenter obtained a very fine ammeter, calibrated 0 to 15 amperes, and proceeded to " test " it by connecting a single $1\frac{1}{2}$-volt dry cell across the terminals. The pointer gave one violent flick over, and returned to zero, after which the instrument was completely dead, and had obviously burned out. A " post-mortem " examination showed that the movement of the instrument was of the moving-coil type, and calibrated for use with an external shunt—which was not connected at the time of the alleged " test." As a result, the coil of the instrument had several hundred times as much current put through it as it was ever intended to carry, and the effect was disastrous. But even if the shunt had been connected, it might still have been damaged, because even a small dry battery is capable of producing an extremely heavy current momentarily, when discharged through a circuit of very low resistance. An ammeter should never, under any circumstances, be connected directly across the source of current, but only in series with a resistance or working circuit passing an amount of current within its range. On the other hand, a voltmeter should always be connected across the supply terminals, but only when the voltage is within its working range.



Double moving-coil instrument calibrated to read r.p.m. of two aircraft engines, in conjunction with d.c. generators of the Air Ministry Mark II type, as illustrated on page 216, February 26th issue (Aero Spares Co.)

Types of Electrical Instruments

Meters which work on electro-magnetic principles are essentially the same whether used for measuring current or voltage.

Most modern electrical instruments are evolved from the simple " galvanometer," which has been used for very many years for the detection of electrical currents. Most of us, no doubt, made an early acquaintance with this simple instrument in our school science lessons, but, briefly, it may

Continued from page 435, " M.E.," April 22, 1948.

be said that it has two essential components—a suspended or pivoted magnetic needle, and a coil of wire, the latter usually flattened in form and partially or completely surrounding the needle. The latter may in some cases be left free to take up a plane parallel to that of the earth's axis, like

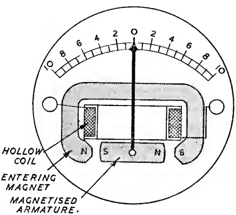


Fig. 1. *Magnetic needle type of measuring instrument*

an ordinary compass needle, but more usually, it is "oriented" by means of a fixed magnet so that it takes up a position at right angles to the axis of the coil when no current is passing through the latter. The effect of current passing through it, however, is to produce a magnetic field in the plane of its axis, tending to pull the needle into line with it, to an extent depending upon the electro-motive force, and in a direction depending upon the respective polarities of the needle and the magnetic field.

Instruments of this type are most useful as detectors, but can be used for measurement of electric current or voltage, though they suffer from the disadvantage that the angular movement of the needle is not proportional to the flow of the current in the coil. Therefore they do not give a constant scale reading, but follow a "tangent rule," the readings decreasing towards the ends of the scale as the needle approaches more closely to alignment with the axis of the coil.

Nevertheless, the principle of the pivoted magnetic needle and stationary coil is often employed in the cheaper types of measuring instruments, where sensitivity or accuracy is not critical. A common application of this principle is found in the charging ammeter employed in automobile electrical systems, where an instrument having a dial with central zero position and readings either side, for "charge" and "discharge" respectively, is usually employed. The form of this instrument is illustrated in Fig. 1, and it will be seen that the movement is not materially different from that of the early galvanometer, except that the magnet used for centring or "orienting" the needle is usually of the "horseshoe" type instead of a straight bar, a common practice being to use a stamping of sheet carbon steel for this purpose. The magnetic "needle" or armature is in the form of a bar which may be specially shaped to obtain a constant scale reading. Such instruments may be obtained very cheaply, and are quite serviceable for general electrical testing, but unless used for purposes similar to those originally intended, the readings are often much too high for work within the scope of the amateur, as the usual reading is from 0 to 20 amperes in both directions. They can, however, be quite easily recalibrated to alter the range of working, by rewinding the coil, which usually has a very small number of turns, not more than about seven in the charging ammeters as described. Assuming that seven turns will produce a full-scale deflection on 20 amperes, rewinding the coil with seventy turns will produce the same results on 2 amperes, so it is only necessary to introduce a decimal point in each of the figures on the scale. This only holds good approximately, but, as already stated, such instruments are not intended to be super-accurate; however, it is advisable where possible to check the instrument against one of known accuracy, and correct either the scale or the number of turns in the coil accordingly.

Moving-iron Instruments

These depend for their operation on the force of attraction or repulsion produced by an electro-magnet on a movable iron armature. Like the preceding type, they are cheap to produce, and are therefore in many cases of comparatively crude construction, though some examples have been made with jewelled pivots. The earlier forms of these instruments often contained a solenoid which was used to attract an iron core against the force of gravity or a return spring, but modern practice favours employing the repulsion effect as produced between two electro-magnets of the same polarity.

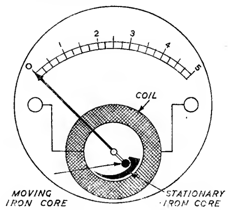


Fig. 2. *Moving-iron type of instrument*

A common example of such an instrument is illustrated in Fig. 2, which shows a coil having an open centre, in which is mounted the pivot bearings of the armature movement. This consists of a plain bar of soft iron, attached to an arm on the pivot shaft, so that it moves bodily round, inside the coil, when the shaft is rotated. A second piece of iron is held stationary

in the coil and is generally of a shape resembling that shown, so as to produce a " magnetic cam " to control the ratio of armature movement.

When current flows through the coil, both pieces of iron come within the influence of its magnetic field, and therefore act as magnets, having their polar axis parallel with the axis of the

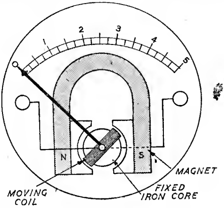


Fig. 3. Moving-coil type of instrument

coil; but being both of the same polarity, they repel each other strongly, and the part which is free to move tries to get as far away from the other as possible. This movement is resisted by a hairspring on the pivot shaft, or in some cases by gravity. It will be seen that the distance between the two pieces of iron at various angular positions of the moving part, is determined by the " cam " form of the stationary part, and this will influence the angle of movement of the pointer in proportion to the magnetic strength; in other words, it can be modified to increase or decrease the rate of scale reading at any point in the range.

Instruments of this type can also be rewound for the purposes of recalibrating, working on the ratio of turns to voltage variation, or inversely to current variation, in the same way. The simple and straightforward form of coil makes it very easy to carry out this operation, and it should further be noted that as there is no definite limit to the size of coil, it may be wound to deal with any current or voltage in reason, making the use of extra shunt or series coils unnecessary, though they are often used, especially in instruments required to have a multiple range, or to act both for voltage and current readings.

The moving iron instrument can be used directly either on a.c. or d.c. supply, though in the former case it is liable to give low readings due to hysteresis, especially if any considerable amount of iron is used in the fixed or moving parts. Other electro-magnetic types of instruments can only be used on a.c. if it is rectified (usually with a small metallic rectifier), and must be recalibrated to compensate for losses in the latter.

Moving-coil Instruments

These are now used for nearly all purposes where high accuracy and sensitivity are required. They may be regarded as an inversion of the magnetic needle type, the magnet being stationary and the coil suspended or pivoted so as to be capable of partial rotation against a delicate return spring. In this way it is possible to use a much more powerful static field, and to keep its strength absolutely constant, by the use of modern high-efficiency magnet steels, while the sensitivity of the movement depends only upon the balance and elimination of friction in the pivot bearings.

As shown in Fig. 3, the moving-coil instrument consists virtually of an electric motor having

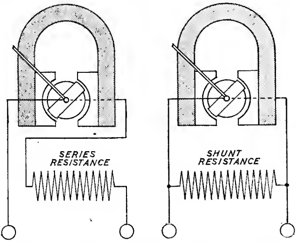


Fig. 4. Moving-coil instrument, arranged for voltage measurement (left) and current measurement (right)

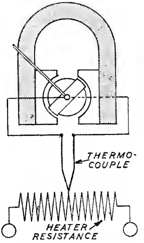


Fig. 5. Thermo-ammeter, in which a moving-coil instrument is operated through a heater and thermo-couple

a permanent magnet, a single-coil armature, and no commutator; its principle of operation is also directly comparable with that of the electric motor, excepting that only the absence of the commutator prevents continuous rotation of the armature, the limit of which is reached when it is exactly at right-angles to the lines of force across the magnet poles.

Like the magnetic needle type, the moving-coil instrument will only work on direct current, and indicates polarity by the direction in which the needle swings. It has one outstanding advantage over the preceding types, in being "dead-beat," or in other words, coming to rest at the correct reading instead of oscillating about the scale first. This is due to the eddy current braking effect of the magnetic field.

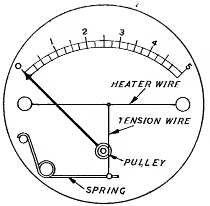


Fig. 6. Hot-wire ammeter

The coil in this type of instrument is usually of very low resistance, to minimise inherent error, and is also of low current-carrying capacity. As a result, it is unsuitable for working directly on either high voltage or heavy current lines, but when used for measurement in these circumstances, must have a resistance connected either in series or parallel. The movement of the instrument is essentially the same for either order of measurement, but the resistances are varied for the purposes of calibration, and must not be altered when once the value for a given range of working has been determined.

In the case of voltage measurements, a high resistance, comprising a large number of turns of very fine resistance wire, is employed, and it is connected in series with the coil of the instrument, as shown in Fig. 4 (left). For use as an ammeter, the resistance is commonly in the form of a heavy wire or bar, often representing only a small fraction of one ohm; it is usually termed a "shunt," being connected in parallel with the instrument coil, as shown in Fig. 4 (right). For voltage readings, the higher the value of resistance in series, the *higher* is the voltage range; for current readings, the higher the value of the shunt resistance, the *lower* is the amperage range. Used without a series or shunt resistance, this type of instrument usually produces a full-scale reading on only a few millivolts or milliamps, and may be used on this range, with due precautions to avoid overloading in either case.

Thermo-ammeters

These are used for the measurement of high-frequency currents, to which the normal type of electro-magnetic meter would not respond, or would give false readings. A common application is for measuring the current discharged by the aerial of a wireless transmitter. The usual method employed in such cases is to make use of the heating effect of the current, and to re-translate this into an electrical effect by means of a thermo-couple, the minute amount of current produced in this way being measured by a sensitive instrument, usually of the moving-coil type. (Fig. 5.)

The complete instrument, therefore, consists of three essential complete parts; the heating element, which is connected in series with the circuit of which current measurement is required; the thermo-couple, which must be in close physical contact with the heating element, but has no electrical connection with it; and the movement of the instrument, connected across the terminals of the thermo-couple. If desired, the latter may be used alone, to serve as a milli- or micro-ammeter (generally the latter, as the currents these instruments have to deal with are very small); or it may be used in conjunction with the thermo-couple, to serve as an electric thermometer, if the dial of the instrument is suitably calibrated in terms of temperature. This, of course, assumes that the complete instrument is not required for current measurement; it need not necessarily be used for high frequency currents, however, and is useful for any d.c. or a.c. current measurement within its range, though recalibration, to work on a different current range, would be rather difficult, neither could it be converted to work as a voltmeter.

Hot-wire Ammeters

These also depend upon the heating effect of the current for their operation, and may be applied to radio-frequency circuits, but are much simpler than the preceding type, and do not involve the use of a secondary electrical measuring instrument. Their action depends on the expansion and relaxation of tension in a heated wire, the main element being of predetermined length and stretched between two fixed points which form the terminals. At or near the centre of the wire, a thin flexible wire is attached; this is not an electrical conductor, but is used to measure the sag of the wire when heated by the passage of electric current. For this purpose, it is carried round a pulley on the pointer shaft of the instrument, and the end is kept under tension by a spring, which may be adjustable to set the zero position of the pointer. (Fig. 6.)

These instruments, also, will only work as ammeters, and are impossible to recalibrate, except by changing the heater element.

There are some types of instruments which do not come into either of the before-mentioned categories, but little need be said about them here, because not only is it rather unlikely that many readers will encounter them, but it is also difficult or impossible to adapt them for other purposes than that for which they were originally designed.

(To be continued)